***HAWAII STATE CIVIL DEFENSE***
***EARTHQUAKE PROGRAM***
***Five-Year Plan, 2005 – 2010* (Draft to supersede earlier plan 2001 -2006)**

***Identify and quantify earthquake and earthquake-related hazards in Hawaii***

| *Item* | *Start date* | *Completion date* | *Status/remarks* |
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| **Multi-hazard Planning** | | | |
| Enable Multi-hazard Data Projects and Products | 2005 | 2010 | Seek and formulate common strategic directions involving partnering efforts of the TTRC, HHAC, HSEAC, and MSAC |
| **Seismic Monitoring** | | | |
| Upgrade Statewide Seismic Monitoring | 1999 | Ongoing | Statewide Broadband Seismic Monitoring, ANSS |
| Establish real-time strong motion data stream | 2002 | 2005 | Upgrade 12 strong-motion stations to real-time operational status |
| Historical and Current Earthquake Catalog compilation, publication and distribution | 1991 | Ongoing maintenance | USGS/HVO catalog posted quarterly at ANSS web site |
| Develop better accessibility to existing data | 2005 | Ongoing | Strong motion accelerogram database user interface |
| Provide input regarding performance & product specifications for Advanced National Seismic System (ANSS) | 2002 | Ongoing | ANSS Regional Advisory Committee liason activities |
| ANSS Structural Instrumentation | 2005 | Submittal TBD | Develop documentation supporting a proposal to install structural accelerograph monitoring in Hawaii County |

| Determine the Regional Hazards due to Geotechnical Site Conditions | | | |
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| *Item* | *Start date* | *Completion date* | *Status/remarks* |
| UH Research of liquefaction potential for calcareous soils using Liquefaction Laboratory and seismic piezocone (SCPT) | 2001 | 2004 | Study regarding code discrepancies in site classification method(i.e. SPT vs. CPT vs. Shear Wave Vs)<br>Further study of light cementation effects for calcareous soils; existing data needs to be evaluated (TBD) |
| Mapping of Hawaii County soil types based on soil profile conditions | 2004 | 2005 | FEMA-NETAP funded project (Awaiting final report documentation) |
| Delineate potential liquefaction hazard and soil type profile data on Maui | 2004 | 2005 | NOAA PSC-funded UH (Nicholson) study |
| Update census tract soil profile types in the HAZUS 99-SR2 model for Hawaii County | 2005 | 2005 | Effects included in "Earthquake Hazards and Estimated Losses in the County of Hawaii" |
| GIS Mapping of soil types for the County of Maui: | 2006 | 2006 | This information will be compiled and interpreted to develop an inventory of subsurface conditions, which will be correlated with regional geologic and soil maps to develop soil classification maps consistent with the engineering criteria of the International Building Code (IBC) and the HAZUS loss estimation methodology. |
| Update hazard and loss calculations based on Maui soil conditions | 2006 | 2007 | HAZUS MH MR2 loss and risk calculations |
| Delineate earthquake-induced landslide hazard areas in the development regions of Hawaii (and later Maui) counties for planning purposes | TBD | | Preliminary first-order evaluation (mapping) of potential hazard sites based on existing maps and past history of slides (emphasis on hazards impacting structures, roadways, lifelines, etc); link with other general studies. Utilize GIS modeling/mapping with spatial and geostatistical analysis tools for achieving topographic scale applicability. Quantitative Liquefaction and/or Earthquake-induced, Landslide model for potential at identified hazard areas (similar to 1991 HLA study) |

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| Soil parameters for event shake map calculations | TBD | | Evaluate Hawaii County soil mapping for applicability to the development of near real-time shake map calculations incorporating soil conditions |
| Generation of shake maps incorporating soil conditions | TBD | | Investigate/verify soil profiles at National Strong Motion Program accelerograph sites to support near real-time scenario shake maps. Additional borings/testing may be needed. USGS equipment may be available for testing. |
| Modeling of associated earthquake effects in addition to ground shaking | TBD | | Delineate potential liquefaction & lateral spreading hazard areas in the County of Hawaii. |

## *Develop State-wide earthquake vulnerability and risk analysis*

| *Item* | *Start date* | *Completion date* | *Status/remarks* |
|---|---|---|---|
| **Formulate Statewide Seismic Loss Model and Risk-Consistent Statewide Policies for Earthquake Loss Mitigation** | | | |
| HAZUS policy modeling scenarios for Hawaii | 2004 | 2004 | Phase V Local County Mitigation Applications: Quantify Loss Reductions and Mitigation Effectiveness of Code Adoption and Enforcement Policies: "Improved Building Code Policies as a Hazard Mitigation Tool for Hawaii County" |
| Develop objectively based risk information products based on the Hawaii seismic risk model for publication, including additional soil types & regional site characteristics | 2004 | 2005 | "Earthquake Hazards and Estimated Losses in the County of Hawaii" booklet<br><br>HAZUS electronic Atlas of Earthquake Scenarios for Hawaii and Maui Counties |
| HAZUS MH Performance Evaluation | 2005 | 2005 | Report on operational factors related to HAZUS 99 and HAZUS MH and identify the transition methodology for the customized Building Inventory Database. |
| Identify user group needs from a feature menu of the customized HAZUS model, in conjunction with the dissemination of the booklet. Update the HAZUS earthquake Atlas using MH MR2 | 2005 | 2006 | Collaborate with Outreach user group workshops for dissemination of the booklet.<br>Develop customized data products for interested Hawaii user groups, when consistent with model capabilities/reliability. Develop additional HSEAC-authorized data products |
| FEMA adoption of the customized Hawaii State data into the HAZUS default | 2004 | TBD | . |
| Transition to HAZUS MH operationally, including comparison | 2006 | 2007 | Migrate customized data if necessary<br>Update customized data products. Produce |

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| of loss estimates and re-validated point data | | | "Earthquake Hazards and Estimated Losses in the County of Maui".<br>Update PDC's Earthquake Atlas for the two regions of Maui and Hawaii after MH MR2 model is released and re-customized. |
| Compile detailed Hawaii and Maui County bridge seismic retrofit performance objective information from DOT for 50-60 bridges, and update HAZUS inventory to reflect more accurate expected bridge loss estimates in SCD data products. | 2006 | TBD | Hawaii County: majority of critical bridges (mostly multi-span) completed<br>Oahu County: Ongoing for Concrete Box Girder bridges with in-span hinges and short bearing seats<br>Maui County: Bridges evaluated for criticality<br>County Bridges: Status of retrofits undetermined except on Oahu<br>Cross-check HAZUS estimated damaged inventory versus current retrofit status. Formulate recommended priority ranking for higher vulnerability bridges not retrofitted.<br>Additional construction features and type of retrofit performed of State Bridges needed for incorporation into the seismic loss estimation model |
| Update shelter building inventory to reflect more accurate design information based on year-built and code policies of each County, using the HAZUS Advanced Engineering Building Module | 2006 | TBD | To be furnished to SCD and the Counties for assessment and re-surveys of existing facilities |
| Customized GIS and RVA tools based on local datasets and methods | TBD | | Development of sector-based products<br>Consider simpler applications not constrained by HAZUS |
| Extend database of essential building inventory. | TBD based on funding and multihazard | TBD based on funding and multihazard | Building Inventory Database Expansion: Pilot Study of Shelter Inventory Collection Methodology<br>Incorporate data requirements for multihazard |

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| | priorities | priorities | applications (hurricane, tsunami, and flood) |
| State and County Hazard Mitigation Plan Updates | 2007 | 2010 | Incorporate HSEAC review and input of HAZUS into Hawaii and Maui County and State plans |

| Vulnerability Analysis and Hazard Mitigation of Essential Facilities | | | |
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| Retrofits to facilities in Hawaii County | 2004 | Ongoing | Wind and Seismic Retrofits to Waiakea, Kaumana, Kailua Maui Memorial and Kula Hospitals |
| Develop Seismic Rating Criteria for Shelters. Evaluation of Hawaii and Maui County essential and critical facilities anticipated to be damaged during earthquakes | 2006 | TBD | Seismic Rapid Visual Screening should be included within assessments performed by the Counties & State Hazard Mitigation Officer; |
| Screening Evaluation of need for strengthening of Hawaii and Maui County essential and critical facilities, including BCA | Could start in 2006 | depending on number | Use Advanced Engineering Building Module to assess individual critical facility building earthquake expected loss to estimate need for actual strengthening |
| If requested and feasible, provide seismic assessment assistance for system lifelines | TBD | | Utilize HAZUS and American Lifeline Alliance Guidelines |

## *Evaluate Hawaii seismic zonation and building codes*

| *Item* | *Start date* | *Completion date* | *Status/remarks* |
|---|---|---|---|
| **Upgrade Building Codes and Develop Local Provisions, as necessary** | | | |
| Work with State, County and professional agencies toward evaluation and adoption, if warranted, of new building codes incorporating HSEAC/USGS seismic hazard mapping and modern seismic provisions | 1990 | 1999<br>**Anticipated mid-2003** | 1997 UBC Hawaii County Zone 4 upgrade<br>**Hawaii County 1997 UBC adoption with HSEAC Seismic Map Amendment incorporating near-field effects** |
| Participate in the development of future seismic code provisions | 1996 | Ongoing | Member Gary Chock represents HSEAC at the National Institute of Building Science's Building Seismic Safety Council, which authors FEMA's NEHRP provisions |
| Track and encourage County adoptions of current IBC or other updated codes | 1990 | Ongoing | Consider additional information products that might help Counties in their code adoption process and timeliness thereof. Consider the International Residential Code (IRC) for single family construction |
| Recommend guidelines for seismic assessments of buildings, structures, essential facilities, transportation, and utility lifelines | 2004 | 2004 | Consider International Existing Building Code (IEBC) & FEMA 356<br>Contact ASCE American Lifeline Alliance & coordinate with State Energy Council, etc. |
| Develop guidelines for county building officials relating to strengthening of existing deficient buildings, structures, essential facilities, transportation, and utility lifelines | 2004 | 2005 | Develop retrofit guidelines and provide adoption language assistance to the counties through SCD<br>Construction guide on Strengthening Existing Houses in Hawaii Against Hurricanes and Earthquakes, 1997<br>Consider International Existing Building Code criteria and a collapse prevention seismic performance objective |

## *Develop and implement Statewide training programs*

| *Item* | *Start date* | *Completion date* | *Status/remarks* |
|---|---|---|---|
| **Hazards Mitigation Training** | | | |
| Nonstructural hazard mitigation and Rapid Visual Screening of buildings training | 2002 | 2003 | Earthquake Safety Workshop for Interior Hazards and Building Vulnerability Analysis, Dept of Interior training personnel, including PDA applications |
| Reduce code adoption inertia by providing Design Professionals training in the use of modern codes and retrofit guidelines | 2003 | 2004 | Develop Distance Learning Training and/or Continuing Education Program with UHH for<br>1. Implementation of new building codes (especially for engineers and county building and planning officials, incorporating review of significant structural provision changes from prior code requirements)<br>2. Retrofit Design Guidelines for Earthquake and Hurricane (include engineers and architects)<br>3. Also make information available on the SEAOH website<br>4. Per FEMA PAO, discuss at SHMF the need for technical education assistance to counties for quicker acceptance of new codes |

## *Public Outreach*

| *Item* | *Start date* | *Completion date* | *Status/remarks* |
|---|---|---|---|
| **Develop Public Outreach Programs and Information Products** | | | |
| Continue outreach to target audiences and expand on audiences, e.g. contractors, builders, building/facility managers and owners, other professional associations | 2003<br><br>2003 | 2004<br><br>2005<br><br><br><br>Ongoing | Provide assistance with use of seismic mitigation guidelines for homeowners; this may involve design professionals<br>Consider component of contractor training in retrofits along the example of post-Northridge FEMA retrofit contractor certification, and utilize UH distance learning capabilities for broader coverage<br>Continue the Public Outreach program with school teachers towards enhancement of earth science curriculum in intermediate and secondary schools |
| Update history of seismic zonation in Hawaii, providing the background information on why new codes need to be adopted soon and why there are so many existing seismically-deficient buildings | 2002 | 2003 | Last prepared in 1991.<br>Update planned to document HSEAC efforts in making seismic code upgrades for Oahu & Hawaii, then leading to a state-of-the-art seismic hazard mapping of the State utilized in the International Building Code and FEMA's NEHRP provisions |
| Electronic and hard copy products from HSEAC projects, and Coordinate with multihazard outreach objectives | 1997 | Ongoing | Scale degree of technical detail to targeted audiences.<br>Recover web pages for SCD residential hurricane and seismic retrofit manual (or re-publish as a downloadable .pdf), also make available in retail outlets |

## *Provide earthquake technical assistance to State of Hawaii*

| *Item* | *Start date* | *Completion date* | *Status/remarks* |
|---|---|---|---|
| **Post-Disaster Damage Assessment and Inspection Training** | | | |
| ATC training for volunteer post-earthquake building inspection engineers<br>Support implementation of standard procedures for post-disaster evaluation of buildings | 1994 | 1998<br><br>2003 | Applied Technology Council (ATC) training in Post Disaster Building Safety Evaluation: Tagging structures with colored placards for occupancy safety - "Red" (Unsafe for occupancy); "Yellow" (Needs further detailed inspection); "Green" (Inspected for occupancy) Earthquake ATC-20 training, 1995; Hurricane ATC-45 training, 1998<br><br>More than 150 volunteers have participated in training. Need to review and update activation procedures, protocols |
| Determine most practical and effective ways to process damage data that considers disaster report requirements and spatial analysis | 2002 | TBD | **This work needs to be done in pre-disaster multihazard planning**<br>**Consider electronic form input of data and integration into Post-Disaster Technical Clearinghouse data archives** |

| Post-Disaster Damage and Safety Inspection and Scientific Data Collection | | | |
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| Review post-disaster volunteer engineer activation procedures. | 2002 | 2003 | Need to update in 2003 and enlist additional younger volunteers |
| Explore teaming with Army Corps of Engineers and DAGS for damage and safety inspections of public facilities | 2003 | 2004 | Coordinate mission assignment protocol with FEMA<br>Coordinate public and private sector coverage responsibilities<br>Integrate SCD's 100+ post-earthquake building inspection volunteer engineers |
| Provide assistance in establishing a **Post-Disaster Technical Clearinghouse** (PDTC) as a shared repository of spatially integrated damage data for disaster response and scientific analysis<br><br>Joint Initiative of the HSEAC and the Tsunami Technical Review Committee (TTRC)<br><br>Called for by the Western States Seismic Policy Council (WSSPC)<br>Per FEMA PAO recommendation, seek pre-disaster mitigation planning funding<br>Per SHMO, incorporate into SCD MOU with PDC | 2002 | Ongoing development; completion TBD based on needed funding support for development and maintenance | **Consists of two principal components:**<br>**1. Clearinghouse Data Server and Host of Website**<br>2. **FEMA DFO with data upload capability**<br>**This work needs to be done in pre-disaster multihazard planning and ensure flexibility for other disasters**<br>Consider parcel-geocoded electronic form input of data via PDA and integration into Post-Disaster Technical Clearinghouse data archives<br>Develop GIS, Database, Mapping, and Report Requirements for the server<br>Partner with Pacific Disaster Center as host in implementing a secure electronic clearinghouse website/ftp with appropriately robust query and sorting capability.<br>UW, CA OES, Project QUAKE, and NOAA COES are possible examples and technical assistance sources |

## *Participate in State multihazard mitigation activities*

| *Item* | *Start date* | *Completion date* | *Status/remarks* |
|---|---|---|---|
| **Assist State and Counties in Multihazard Mitigation Activities** | | | |
| Provide technical assistance in development of earthquake information products through State of Hawaii Hazard Mitigation Forum (SHMF) | 2002 | Ongoing | 2 HSEAC voting members on SHMF |